Executive Summary

Temperature Probe Assemblies are installation-ready temperature measurement assemblies offered with temperature transmitters, sensor heads, sensors, thermowells and process connections. They eliminate the need for special field wiring, since the assemblies are fully certified, and offer users faster installation and commissioning, and improved overall accuracy of temperature measurement. They are ideal for process manufacturers, Original Equipment Manufacturers and Engineering Procurement Construction contractors for temperature measurement. This white paper addresses the need and critical considerations while choosing explosion-proof Temperature Probe Assemblies.
Why are explosion-proof Temperature Probe Assemblies necessary?

Temperature measurement applications in industrial environments will likely involve the use of temperature sensors such as RTDs and thermocouples in conjunction with local temperature transmitters. If the application involves high pressure, high temperature, corrosive or abrasive applications then it may necessitate the use of several accessories such as thermowells, fittings, extensions, etc. When these measurements take place in a hazardous area, it becomes extremely important to qualify the different component combinations as safe. All assemblies must be manufactured and installed specifically to meet the requirements of the hazardous area.

Ready-to-install Temperature Probe Assemblies with the necessary agency approvals from reputed manufacturers will ensure safety and reliability for users.

Certification of explosion-proof Temperature Probe Assemblies

In North America, third-party certification of Temperature Probe Assemblies is necessary. Some third-parties such as Factory Mutual (FM) and the Canadian Standards Association (CSA) are widely recognized authorities. In Europe, the ATEX Directive is required. National Institute of Metrology, Quality and Technology (INMETRO) approvals are widely popular and accepted in Latin American countries such as Brazil.

What does it take to build and certify explosion-proof Temperature Probe Assemblies?

The significance of this question lies in the fact that capping a sensor with an explosion-proof head may not make the assembly explosion-proof. For reliability and safety, all the sub-assemblies and their components have to be designed, tested and assembled according to the requirements of various approvals agencies. They must also be installed in the field according to the manufacturer’s instructions.

Unlike other common process measurements like pressure, the sensors of temperature measuring instruments are external to the temperature transmitters, making it more challenging to build explosion-proof assemblies for the complete offering.

No single part of the assembly can be non-explosion-proof. Declaration of the assembly as safe based on part of the assembly rating is not permitted. When installing the temperature sensor in a hazardous location, due attention should be paid to all parts of the assembly, and not just any one component. Following are some of the key design requirements for different components of the assembly:

- **Housing:** Must be rated to meet the degree of safety classified by the area, and to work in consideration with the surrounding components.
• **Transmitter**: Must be rated to meet the degree of safety classified by the area, and to work in consideration with the surrounding components.

![Temperature transmitters to suit the hazardous area classification.]

• **Thread**: Must meet minimum thread engagement requirements, and may have more specific requirements such as tapered thread instead of straight.

![Thermowell with tapered thread with minimum thread engagement.]

• **Extension**: May contain sufficiently long flame paths that in the event of an explosion would allow flammable gases to cool beyond the point of ignition.

• **Flame path**: The extension piece that connects the transmitter housing to the thermowell can either be designed so it is strong enough to contain a potential explosion, or it can be equipped with a so-called “flame path” as part of an explosion-proof XP (FM, CSA) or flame-proof (A) Exd (FM, CSA and TEX) assembly. A “flame path” is made up of a cylindrical shaft that is part of the sensor and a flame path fitting that is part of the extension or the transmitter housing. The length of the fitting and tightly controlled tolerances between the shaft and the flame path housing ensure that no ignition of any flammable atmospheres can occur outside of the explosion-proof or flame-proof transmitter housing.

![Explosion-proof union nipples with 5”, 7” and 9” extension lengths.]

Sensors: The sensors selected may not possess the energy to spark or cause an ignition.

Testing: After meeting the design codes for all the sub-assemblies including head body, cover, extension, thermowell, lag etc., additional testing as required by the approval agencies is carried out. Only after thorough testing and documentation can assemblies be approved as explosion-proof. Once the assemblies are approved as explosion-proof, the manufacturer is not entitled to change the design of the assembly without agency approval.

In view of the above, the use of an explosion-proof head with unapproved sensor or thermowell would not provide the safety and reliability needed for the plant and the personnel.

Types

Temperature Probe Assemblies are installation-ready temperature measurement assemblies offered with several models of smart temperature transmitters, sensor heads, sensors, thermowells and process connections. Typically these are available in three versions:

- Rigid probe assembly.
- Threaded and socket weld thermowell assembly.
- Drilled and flanged thermowell assembly.

User benefits

Integrated Temperature Probe Assemblies with transmitters save users time in terms of engineering, ordering and installation/commissioning since they come in ready-to-install, fully calibrated assemblies with global agency approvals (e.g. FM, CSA, ATEX, INMETRO).
Industries and applications

In view of the benefits outlined above, integrated Temperature Probe Assemblies along with temperature transmitters are used to meet diverse needs ranging from temperature measurement in hazardous locations such as boilers, flare systems, gas pipelines, gas stations, flow metering skids, compressors, drill ships, reactors and other processing units across the power, oil & gas, chemical, petrochemical and bio-fuel industries.

Conclusion

Integrated Temperature Probe Assemblies along with temperature transmitters offer a single-stop solution for temperature measurements in safe as well as hazardous locations, thereby enhancing the safety, reliability and efficiency of plant assets and people. Due consideration should be given to specifying, evaluating and qualifying the appropriate solution that meets the explosion-proof requirements for specific hazardous area applications.